1. A high temperature superconducting rotor, comprising:

a high temperature superconducting field winding,

a field winding support concentrically arranged about the high temperature superconductor field winding, and

a thermal reserve concentrically arranged about the field winding support and thermally coupled to the field winding to maintain a temperature differential between the thermal reserve and the field winding not greater than about 10 K.

2. The rotor of claim 1 wherein the thermal reserve comprises a material that is thermally conductive.

3. The rotor of claim 2 wherein the thermal reserve comprises a material that is electrically nonconductive.

4. The rotor of claim 3 wherein the thermal reserve comprises a ceramic material.

5. The rotor of claim 3 wherein the thermal reserve comprises Alumina.

6. The rotor of claim 3 wherein the thermal reserve comprises ATTA®.

7. The rotor of claim 3 wherein the thermal reserve comprises Beryllium Oxide.

8. The rotor of claim 2 wherein the thermal reserve comprises an

electrically conductive material.

9. The rotor of claim 8 wherein the electrically conductive material includes segmentation in a direction normal to the axis of the rotor.

10. The rotor of claim 8 wherein the electrically conductive material includes segmentation in a direction along the axis of the rotor.

11. The rotor of claim 8 wherein the electrically conductive material comprises aluminum shrunk fit over the field winding support.

12. The rotor of claim 1 further comprising a banding concentrically arranged about the thermal reserve.

13. The rotor of claim 12 wherein the banding comprises an electrically conductive material.

14. The rotor of claim 13 wherein the electrically conductive material includes segmentation in a direction normal to the axis of the rotor.

15. The rotor of claim 12 wherein the banding comprises an electrically nonconductive material.

16. The rotor of claim 15 wherein the banding comprises Kevlar.

17. The rotor of claim 15 wherein the banding comprises glass fiber.

18. The rotor of claim 1 further comprising an outer layer concentrically arranged about the thermal reserve, the outer layer comprising a thermally non-conductive material

19. The rotor of claim 18 wherein the outer layer comprises an electrically nonconductive material.

20. The rotor of claim 18 wherein the outer layer comprises an electrically conductive material.

21. The rotor of claim 20 wherein the electrically conductive material is configured to prevent the flow of eddy currents within the electrically conductive material.

22. The rotor of claim 21 wherein the outer layer comprises multiple layers of aluminum coated mylar.

23. The rotor of claim 22 wherein the aluminum coating includes segments whereby electric current does not flow in a direction along the axis of the rotor.

24. The rotor of claim 18 further comprising a banding concentrically arranged about the outer layer.

25. A machine comprising:

a rotor, said rotor comprising

a high temperature superconducting field winding,

a field winding support concentrically arranged about the field winding for securing the field winding, the support being electrically isolated from the field winding,

an AC flux shield concentrically arranged about the field winding, and

a thermal reserve concentrically arranged about the AC flux shield and thermally coupled to the field winding to maintain a temperature differential between the thermal reserve and the field winding not greater than about 10 K; and

a stator concentrically arranged about the rotor.

26. The machine of claim 25 further comprising a cryogenic refrigeration system thermally coupled to the rotor.

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27. A method of limiting the rate of increase in the temperature of a superconducting winding, comprising:

concentrically arranging a thermal reserve about and in thermal contact with the superconducting winding, and

maintaining a temperature diferential between the thermal reserve and the field winding no greater than about 10 K.

28. The method of claim 27 wherein the thermal reserve comprises a thermally conducting material.

29. The method of claim 28 further comprising:

concentrically arranging a thermally nonconductive material about the

thermally conductive material.

30. The method of claim 27 further comprising:

configuring the thermal reserve to suppress electric eddy currents from flowing about the superconducting winding.

31. A high temperature superconducting rotor, comprising:

a high temperature superconducting field winding,

a field winding support concentrically arranged about the high temperature superconductor field winding, and

a thermal reserve concentrically arranged about the field winding support, the thermal reserve including ATTA® which is thermally conductive and electrically nonconductive.